

FUNDAMENTALS OF TRIAL ADVOCACY COURSE

October 5 – 8, 2020
Phoenix, Arizona



DUI BLOOD ANALYSIS ISSUES

Presented by:

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&

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Distributed by:

ARIZONA PROSECUTING ATTORNEYS' ADVISORY COUNCIL
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DUI Blood Analysis

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Blood Alcohol Analysis

General Alcohol

Absorption, Elimination, and Distribution
Impairment/Intoxication
Tolerance
Officer Tools – Driving Cues and SFSTs

Blood Alcohol

Blood Draw
Property and Evidence
Notes
Analysis
Quality Assurance

Alcohol

Common Types

NAME	FORMULA	BOILING POINT	USES	TOXICITY AND METABOLITES
Methanol	CH ₃ -OH	64.5°C / 148.1°F	Denaturant Solvent Paint Remover Fuel	≈ 75ML Formic Acid
Ethanol	CH ₃ CH ₂ -OH	78.3°C / 172.9°F	Beverage Solvent Medicinal Vehicle Fuel	≈ 400-500ML Acetaldehyde (Acetic Acid)
Isopropanol	CH ₃ CH(OH) CH ₃	82.3°C / 180.1°F	Denaturant Antiseptic	≈ 250ML Acetone
Ethylene Glycol	CH ₂ -OH CH ₂ -OH	198°C / 388.4°F	Coolant Solvent	≈ 100ML Oxalic Acid

Absorption

How does it enter the body?

Oral Consumption

Injection

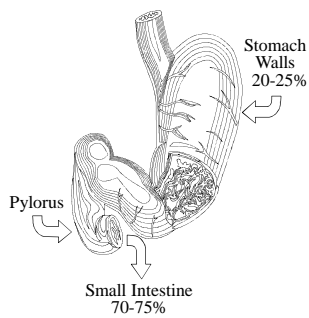
Inhalation

Through the skin

Enema

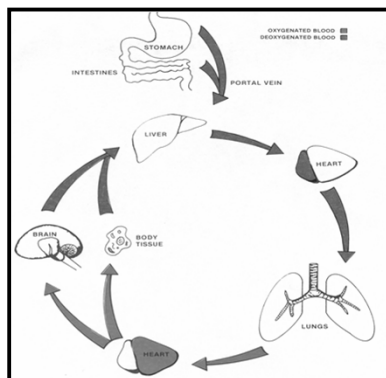
Absorption

How does ethanol enter the body?



Distribution

How does ethanol move around in the body?



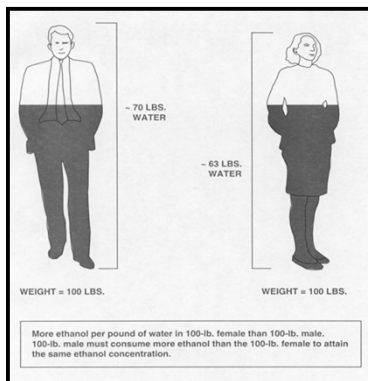
Distribution

Ethanol Concentration vs. Water Content



Distribution

Ethanol Concentration vs. Water Content



Per Drink Calculation

Widmark Formula

$$A = PRC$$

A = Alcohol (amount and concentration)

P = Weight

R = Widmark Number (water content)

C = BAC

Elimination

How does ethanol leave the body?

Metabolism (liver)

Excretion (urine)

Evaporation (breath)

Elimination

Metabolism

Rate at which ethanol is oxidized varies
from one person to another

Elimination rates range from 0.010% to
0.030% per hour

Average rate of elimination is 0.018%
per hour

Retrograde Calculation

Used if chemical test is outside two hours
from the time of driving

Argument does not apply to (A)(1) or (A)(3)

State may retrograde readings to any time
within two hours of driving/APC for per se
statutes

Meets Rule 702 requirements.

O'Neill v. Superior Court, (Kankelfritz, RPI), 187 Ariz. 440 (App. 1996);
State v. Claybrook, 193 Ariz. 588 (App. 1998); *State v. Montgomery*,
(Madrid, RPI) 234 Ariz. 289 (App. 2014).

Retrograde Calculation

Practice pointer – be sure to disclose the forensic scientist you will call and his/her opinion re: retrograde.

State v. Roque, 213 Ariz. 193 (2006); Rule 15.

Retrograde Calculation

Information Needed

Drinking and eating history over past hour
Time of test
Test result
Time of driving

Ask your expert prior to trial.

Retrograde Calculation

How to Get Your Test Within Two Hours - Retrograde Extrapolation

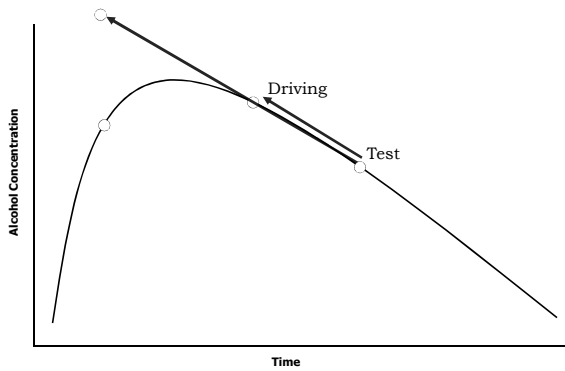
Given certain information, can you calculate the alcohol concentration at a time earlier than the test? (Yes)

What information do you need?

Assuming _____ (fill in the facts from your case) would you please calculate the defendant's alcohol concentration at _____ (time of driving or a point within the 2 hr window)?

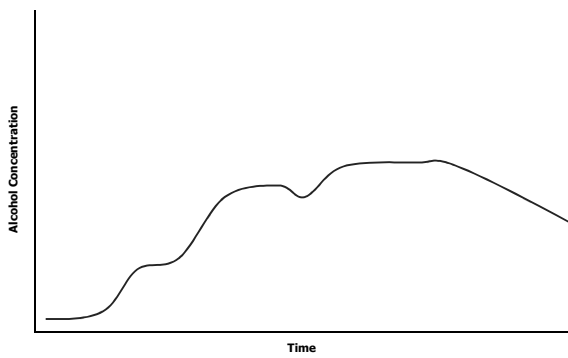
Alcohol Concentration Curve

Bolus Drinking Scenario



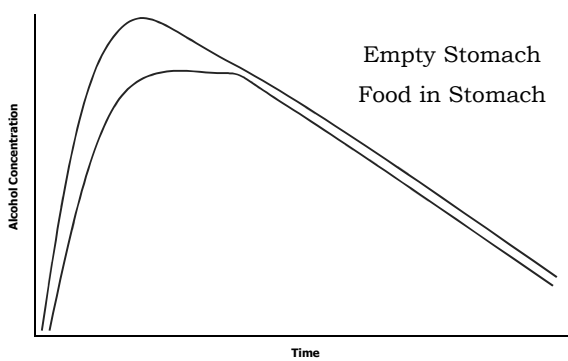
Alcohol Concentration Curve

"Typical" Drinking Scenario



Alcohol Concentration Curve

Food Effect on Absorption



Impairment

vs. Intoxication

Impairment - based upon measurable changes in an individual's performance of a specific task, such as operating a motor vehicle

Intoxication - advanced state of impairment in which gross physical signs of the effects of alcohol are apparent

Impairment

COGNITIVE	SENSORY	MOTOR FUNCTION
Judgment impaired	Near to far vision	Fine muscle control
Sense of caution diminished	Visual acuity	Speech
Drivers often become aggressive risk takers; impulsive	Glare resistance	Balance
Lack self-criticism	Glare recovery	Coordination
Attribute to themselves many qualities which they do not possess	Binocular vision	Walking
Brain's ability to integrate information becomes impaired	Reaction time to optical and acoustical stimuli	Horizontal gaze nystagmus (HGN)
Thoughts clouded	Complex coordination tasks	
Loss of finer grades of attention, observation and comprehension		
Unaware of errors and omissions		
Impairment of short-term memory		

Tolerance

Two Types of Tolerance

Metabolic

Functional

Despite tolerance, all people are still impaired to operate a motor vehicle at 0.08 AC

Tolerance

Metabolic

Tolerance that results in a more rapid elimination of alcohol from the body

Innate – genetics and constitution

Exposure dependent – Microsomal Ethanol Oxidizing System (MEOS)

Tolerance

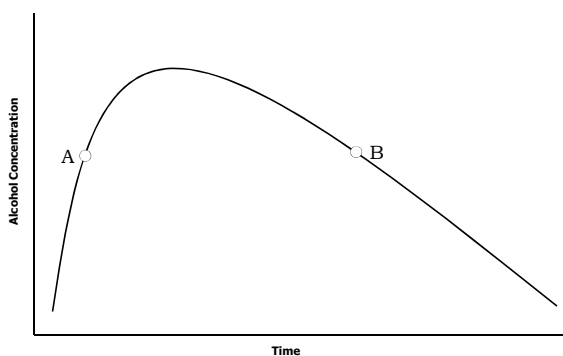
Functional

Tolerance that develops when brain functions adapt to compensate for the disruption in both behavior and bodily functions

Acute – impairment is greater when measured soon after alcohol is consumed than when measured later in the drinking session

Tolerance

Acute



Tolerance

Functional

Chronic – some impairing factors of alcohol are lessened by the central nervous system's response to many drinking sessions

Officer Tools

NHTSA Driving Cues

Failure to maintain lane position

weaving, straddling lane line, turning to wide, drifting in lane

Speed / Braking problems

stops short at intersection, not maintaining constant speed, driving ten or more miles below speed limit

Vigilance

slow to respond to respond to traffic signal, driving without headlights on, wrong way on street, failure to signal

Judgment

tailgating, unsafe lane change, jerky to fast turn, odd behavior in car

Look For Clues That Are Not NHTSA Clues

Officer Tools

Driving Cues

Validation - NHTSA performed three field studies that encompassed more than 12,000 stops

Any one cue = 35% likelihood over 0.08%
Any two cues = 50% likelihood over 0.08%

Weaving = 65% likelihood over 0.08%
Driving on wrong side of road = 70% likelihood over 0.08%

NHTSA Driving Clues

Rule 702/*Daubert* should only apply to the percentages

Officer Tools

Standardized Field Sobriety Tests (SFSTs)

History

NHTSA sponsored three studies to arrive at the current battery of three SFSTs

Psychophysical Tests For DWI Arrest, California (1977)

Development and Field Test Of Psychophysical Tests For DWI Arrest, California (1981)

Field Evaluation Of A Behavioral Battery For DWI, Maryland, D.C., V.A. N.C. (1983)

Officer Tools

Standardized Field Sobriety Tests (SFSTs)

History

Three additional studies standardized the tests, finalized grading, and proved correlation to BAC

Colorado ,1995 (234 acceptable subjects) SCRI
163 arrests out of 175 arrests were correct (93%)

Florida 1997 (256 acceptable Subjects) SCRI
197 arrests out of 206 arrests were correct (95%)

San Diego, 1998 (234 acceptable subjects) Anacapa
210 arrests out of 234 arrests were correct (90%)

Officer Tools

Standardized Field Sobriety Tests (SFSTs)

Horizontal Gaze Nystagmus (HGN)

Involuntary jerking of the eyes

4 of 6 clues = 88% total accuracy (average)
(Your officer is likely better)

4 or more clues indicates BAC .08 or greater

6 Clues (3 in each eye)

Lack of smooth pursuit
Nystagmus at maximum deviation
Onset of nystagmus before 45 degrees

Officer Tools

Standardized Field Sobriety Tests (SFSTs)

Walk and Turn

2 of 8 clues = 79% total accuracy (average
for above .08 BAC)

Can't correlate # of cues to BAC in AZ

8 Clues

Loses balance during instructions
Starts before the instructions are finished
Stops while walking
Does not touch heel to toe
Steps out of line
Uses arms to balance
Improper turn
Incorrect number of steps

Officer Tools

Standardized Field Sobriety Tests (SFSTs)

One Leg Stand

2 of 4 clues = 83% total accuracy (average
for above .08 BAC)

Can't correlate # of cues to BAC in AZ

4 Clues

The suspect sways while balancing
Subject uses his arms to balance
Subject hops while balancing
Subject puts foot down

SFSTs

Rule 702/*Daubert* does not apply to
the walk & turn and one leg stand.

State v. Superior Court (Blake, RPI)
718 P.2d 171 (1986).

- So compliance with the studies
should not affect admissibility
- Includes age, weight, physical
condition, etc.

Studies reviewed correlation of
BAC to Cues on SFSTs. Cannot do
that in AZ. *Albrect*

Blood Alcohol Analysis

Phlebotomy Blood Draw Kits

NIK, Lynn Peavey, and Tri-Tec

Outer box

Inner box

Plastic bag, tray

2 vacuntainer tubes (grey top)

Preservative - sodium fluoride

Anticoagulant - potassium oxalate

Vacuum dated for freshness

1 non-alcoholic swab

Iodine

Benzalkonium chloride

Butterfly needle

Evidence seals

Blood Alcohol Analysis

Property and Evidence

Agency Request For Scientific Examination

Chain of Custody

Requests disseminated to appropriate unit

Blood refrigerated in walk in cooler

Blood Alcohol Analysis

Evidence Notes

Arizona Department of Public Safety
Evidence Notes
PR 3-2016
Analyst: Sarah Buckner #10022

BA Initials / Start Date	seb 3-24-16
Package	Blood kit
Outer package sealed?	Yes
Inner package sealed?	No
Number of tubes rec'd	2
Tube size A	10mL
Approx. vol. mL (A)	7
Type of Tube (A)	Grey top (can't see label)
Tube Sealed? (A)	Yes
Time on tube (A)	0314
Tube Analyzed? (A)	Yes
Tube size B	10mL
Approx. vol. mL (B)	5
Type of Tube (B)	Grey top (can't see label)
Tube Sealed? (B)	Yes
Time on tube (B)	0314
Tube Analyzed? (B)	RNA

Standard & Controls OK ☒ Initials / End Date: GMP 3-24-16

Blood Alcohol Analysis

Evidence Notes

Unit	fa/tox
BA Initials / Start Date	seb 3-24-16
Package	Blood kit
Outer package sealed?	Yes
Inner package sealed?	No
Number of tubes rec'd	2
Tube size A	10mL
Approx. vol. mL (A)	7
Type of Tube (A)	Grey top (can't see label)
Tube Sealed? (A)	Yes
Time on tube (A)	0314
Tube Analyzed? (A)	Yes
Tube size B	10mL
Approx. vol. mL (B)	5
Type of Tube (B)	Grey top (can't see label)
Tube Sealed? (B)	Yes
Time on tube (B)	0314
Tube Analyzed? (B)	RNA

Blood Alcohol Analysis

Evidence Notes

Arizona Department of Public Safety
Evidence Notes
FD-302 (Rev. 11-2014)
Ariz. State Police (APD)

Item	Quantity	Unit of Measure	Location	Date/Time	Initials	Signature
1						
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3						
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99						
100						

Standard A Control OK ☐ Initials / End Date: 5/15/15

Blood Alcohol Analysis

Evidence Opening

Notes

One sample open at a time
Seals – evidence tape (not air tight)
Number of tubes
Name
Anything else

Blood Alcohol Analysis

Evidence Opening

Ensure homogeneity of sample
Rock the blood baby
Vortex
Tissue Grinder
Ensures homogeneity of sample

Blood Alcohol Analysis

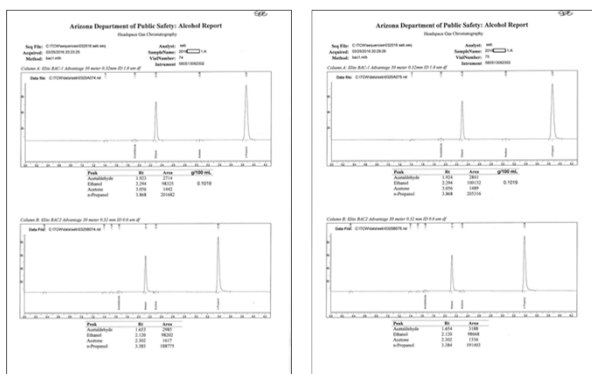
Pipet Samples

One open at a time
(Conical cup)
100 Microliters
1 mls of internal standard
Crimp

Pipetter/Diluter

Blood Alcohol Analysis

Internal Standard Method



Blood Alcohol Analysis

Internal Standard Method

Arizona Department of Public Safety - Alcohol Report			
Sample No. 123456789	Sample Name	Sample Date	Sample Time
Sample No. 123456789	Sample Name	Sample Date	Sample Time
Peak	Rt	Area	g/100 mL
Acetaldehyde	1.923	2714	
Ethanol	2.294	98325	0.1019
Acetone	3.056	1442	
n-Propanol	3.868	201682	

Peak	Rt	Area	g/100 mL
Acetaldehyde	1.924	2841	
Ethanol	2.294	100132	0.1019
Acetone	3.056	1489	
n-Propanol	3.868	205316	

Blood Alcohol Analysis

Internal Standard Method

Area Counts

Ethanol - 98325

n-propanol - 201682

Area Counts

Ethanol - 100132

n-propanol - 205316

Ratio

98325/201682 =
0.487

Ratio

100132/205316 =
0.487

Headspace Gas Chromatograph

(PerkinElmer GC & Autosampler)

Blood Alcohol Analysis Report

Report

ARIZONA DEPARTMENT OF PUBLIC SAFETY
SCIENTIFIC EXAMINATION REPORT

AGENCY: []
AGENCY NO.: []
ANALYST: []
ANALYST NO.: []
EXAMINATION REQUESTED: []
EXAMINATION RESULTS: []
RESULTS/INTERPRETATION: []

Current reports

- average readings
- include uncertainty budget

Blood Alcohol Analysis Discovery

Discovery

“Standard Disclosure”

Scientific Analysis Report

Analyst Notes

Chromatograms for subject's sample

Chain-of-custody

Run summary of Quality Assurance

“Control Packet”

Everything included in Standard Disclosure

Chromatograms for Quality Assurance

Blood Alcohol Analysis How to Admit Blood Alcohol Results

How to Admit Blood Alcohol Results

Sample Collection

Establish:

- when, where & by whom sample was collected
- refrigeration
- swab, tube contents, etc.

Defense may stipulate

Blood Alcohol Analysis

How to Admit Blood Alcohol Results

Chain of Custody

Prove sample tested at the lab is the defendant's sample

What was sample collected in?

How was it labeled?

Protocols

Photo

Defense may stipulate to part or all of chain

Blood Alcohol Analysis

How to Admit Blood Alcohol Results

Chain of Custody

Challenges to the chain of custody go to the weight, not the admissibility of evidence

The defendant must make some showing that the evidence has been tampered with

State v. Morales, 170 Ariz. 360 (App. 1991)

Rule 702

5 Portions of the Rule

- "A witness who is qualified as an expert by knowledge, skill, experience, training, or education may testify in the form of an opinion or otherwise if:"

➤ #1 must qualify witness as an expert

➤ Thoroughly qualify your witness

5 Portions of Rule 702 #2

- “a) The expert’s scientific, technical, or other specialized knowledge will help the trier of fact to understand the evidence or to determine a fact in issue”

- Blood testing embraces scientific, technical & other specialized knowledge
- So just relevance

5 Portions of Rule 702 #3

- b) The testimony is based on sufficient facts or data

- Factual basis for opinion
 - Have expert explain basis for opinion
- Can the opinion, reasoning or method be properly applied to the facts in issue?
- What did they do? How did they do it?

5 Portions of Rule 702 #4

- c) The testimony is the product of reliable principles and methods

- This is similar to *Frye* (accepted in relevant scientific community) – Lay the *Deason* foundation +
- Quality assurance
- Method - Gas Chromatography is reliable & has been tested
 - Studies
 - By manufacturer
 - Lab validation

5 Portions of Rule 702 #5

- d) the expert has reliably applied the principles and methods to the facts of the case.
 - Case specific
 - Did this witness do it correctly
 - Focus is on principles & methodology
 - The accepted technique was properly applied and the results accurately recorded

Daubert !

(Rule 702)

- Qualify witness as an expert
- Chain of custody (prove it was defendant's blood)
- What method was used
 - Establish scientific reliability
- What did he/she do?
- Emphasize quality assurance/reliability

Blood Alcohol Analysis

How to Admit Blood Alcohol Results

Deason/Daubert

Establish general acceptance of underlying science (i.e. Infrared Spectrophotometry, Gas Chromatography or Mass Spectrometry).

Is the method used accepted in the relevant scientific community as a valid method for breath/blood/urine testing?

Blood Alcohol Analysis

How to Admit Blood Alcohol Results

Deason/Daubert

Based on a review of the procedure used in analyzing the sample, the test results, and records:

- The accepted technique was properly used
- The readings are an accurate measurement and recording of the defendant's alcohol concentration (or the presence of drugs)
- The test results would be accepted in the relevant scientific community as valid test results (legally not required but judge may)

Blood Alcohol Analysis

Headspace Gas Chromatography

Measures alcohol content in the
air above the blood

Standard in the scientific
community for blood alcohol
analysis

Blood Alcohol Analysis

Henry's Law

In a closed system, the
concentration of a volatile
substance above a fluid is
proportional to the concentration
of that substance in the fluid at
equilibrium

Blood Alcohol Analysis

PerkinElmer Clarus 500 w/ Turbomatrix HS110

Blood Alcohol Analysis

Chromatography

Blood Alcohol Analysis

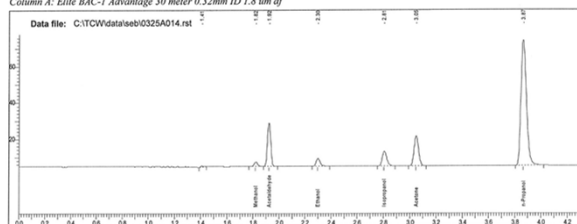
Chromatography

[illegible][illegible]

Mix Standard

Separation of Common Volatiles

Column A: Elite BAC-1 Advantage 30 meter 0.32mm ID 1.8 um df

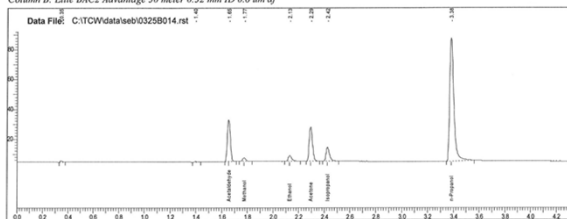


Peak	Rt	Area	g/100 mL
Methanol	1.822	4795	
Acetaldehyde	1.923	43251	
Ethanol	2.298	9049	0.0105
Isopropanol	2.807	19452	
Acetone	3.049	39282	
n-Propanol	3.866	202548	

Mix Standard

Separation of Common Volatiles

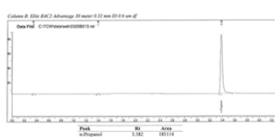
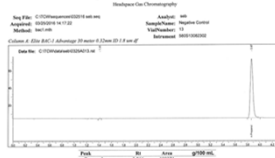
Column B: Elite BAC2 Advantage 30 meter 0.32 mm ID 0.6 um df



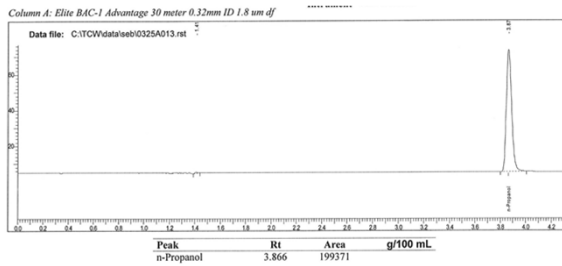
Peak	Rt	Area
Acetaldehyde	1.653	46319
Methanol	1.773	4436
Ethanol	2.129	7767
Acetone	2.291	40912
Isopropanol	2.423	17897
n-Propanol	3.382	186498

Negative

Arizona Department of Public Safety: Alcohol Report

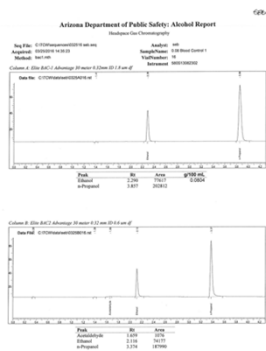


Negative

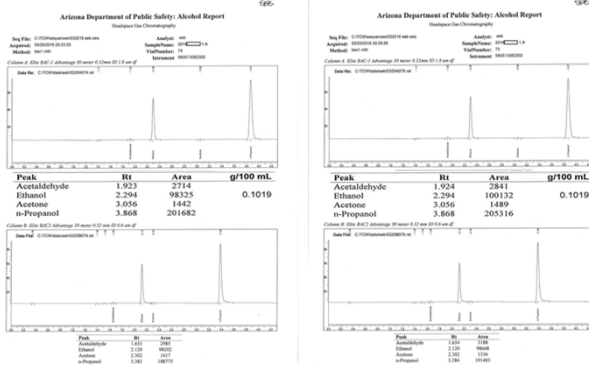


Controls

Aqueous and Whole Blood



Cases Run in Duplicate



Verification Standards

Same as Calibration Standards

Analyzed at the end of run

Verifies pipettor and calibration stability

Will only see in older cases

Blood Alcohol Analysis

Batch Sequence

Sequence Sample Descriptions - Channel A

Row	Type	Name	Number
1	Cal	Reference 0.02%	001
2	Cal	Reference 0.02%	002
3	Cal	Reference 0.02%	003
4	Cal	Reference 0.02%	004
5	Cal	Reference 0.1%	005
6	Cal	Reference 0.1%	006
7	Cal	Reference 0.1%	007
8	Cal	Reference 0.2%	008
9	Cal	Reference 0.2%	009
10	Cal	Reference 0.3%	010
11	Cal	Reference 0.3%	011
12	Cal	Reference 0.4%	012
13	Blank	Blank	013
14	Blank	Blank	014
15	Cal	Reference 0.4%	015
16	Cal	Reference 0.5%	016
17	Cal	Reference 0.5%	017
18	Cal	Reference 0.5%	018
19	Cal	Reference 0.5%	019
20	Cal	Reference 0.5%	020
21	Cal	Reference 0.5%	021
22	Cal	Reference 0.5%	022
23	Cal	Reference 0.5%	023
24	Cal	Reference 0.5%	024
25	Cal	Reference 0.5%	025
26	Cal	Reference 0.5%	026
27	Cal	Reference 0.5%	027
28	Cal	Reference 0.5%	028
29	Cal	Reference 0.5%	029
30	Cal	Reference 0.5%	030
31	Cal	Reference 0.5%	031
32	Cal	Reference 0.5%	032
33	Cal	Reference 0.5%	033
34	Cal	Reference 0.5%	034
35	Cal	Reference 0.5%	035
36	Cal	Reference 0.5%	036
37	Cal	Reference 0.5%	037
38	Cal	Reference 0.5%	038
39	Cal	Reference 0.5%	039
40	Cal	Reference 0.5%	040
41	Cal	Reference 0.5%	041
42	Cal	Reference 0.5%	042
43	Cal	Reference 0.5%	043
44	Cal	Reference 0.5%	044
45	Cal	Reference 0.5%	045
46	Cal	Reference 0.5%	046
47	Cal	Reference 0.5%	047
48	Cal	Reference 0.5%	048
49	Cal	Reference 0.5%	049
50	Cal	Reference 0.5%	050
51	Cal	Reference 0.5%	051
52	Cal	Reference 0.5%	052
53	Cal	Reference 0.5%	053
54	Cal	Reference 0.5%	054
55	Cal	Reference 0.5%	055
56	Cal	Reference 0.5%	056
57	Cal	Reference 0.5%	057

Sequence Sample Descriptions - Channel A

Row	Type	Name	Number
58	Cal	Reference 0.5%	058
59	Cal	Reference 0.5%	059
60	Cal	Reference 0.5%	060
61	Cal	Reference 0.5%	061
62	Cal	Reference 0.5%	062
63	Cal	Reference 0.5%	063
64	Cal	Reference 0.5%	064
65	Cal	Reference 0.5%	065
66	Cal	Reference 0.5%	066
67	Cal	Reference 0.5%	067
68	Cal	Reference 0.5%	068
69	Cal	Reference 0.5%	069
70	Cal	Reference 0.5%	070
71	Cal	Reference 0.5%	071
72	Cal	Reference 0.5%	072
73	Cal	Reference 0.5%	073
74	Cal	Reference 0.5%	074
75	Cal	Reference 0.5%	075
76	Cal	Reference 0.5%	076
77	Cal	Reference 0.5%	077
78	Cal	Reference 0.5%	078
79	Cal	Reference 0.5%	079
80	Cal	Reference 0.5%	080
81	Cal	Reference 0.5%	081
82	Cal	Reference 0.5%	082
83	Cal	Reference 0.5%	083
84	Cal	Reference 0.5%	084
85	Cal	Reference 0.5%	085
86	Cal	Reference 0.5%	086
87	Cal	Reference 0.5%	087
88	Cal	Reference 0.5%	088
89	Cal	Reference 0.5%	089
90	Cal	Reference 0.5%	090
91	Cal	Reference 0.5%	091
92	Cal	Reference 0.5%	092
93	Cal	Reference 0.5%	093
94	Cal	Reference 0.5%	094
95	Cal	Reference 0.5%	095
96	Cal	Reference 0.5%	096
97	Cal	Reference 0.5%	097
98	Cal	Reference 0.5%	098
99	Cal	Reference 0.5%	099
100	Cal	Reference 0.5%	100

Quality Assurance

Review

Technical Review

Administrative Review

Responding to Defense Foundational Objections

If in Doubt
Weight not admissibility

All the State is required to do is lay the basic foundation. Any remaining issues go to the weight, not the admissibility, of the evidence.

State v. Plew, 155 Ariz. 44 (1987); *State v. Superior Court (Weant, RPI)*, 172 Ariz. 153 (App. 1992).

Battle of the Experts

Disagreements between expert witnesses go to weight, not the admissibility. *State v. Velasco*, (*Alday*, RPI), 165 Ariz. 480, 486, (1990).

Where there is a lack of unanimity in scientific community on accuracy of a breath test, "the scientific disagreement affects only the weight and not the admissibility of evidence." *State v. Olivas*, 77 Ariz. 118 (1954).

Your Criminalist and You

Can do drink calculations

"One beer" How big would that be?

Retrogrades

Effect of alcohol on humans

Explain "issues" with the Intox/GC

Rebut defense expert's testimony

Questions?

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